

## CLAIMS:

1. A method of making an excimer laser crystal optic, said method comprising:
  - providing a magnesium fluoride crystal solid precursor
  - nonmetallically crushing said magnesium fluoride solid precursor to provide a crushed low metal contaminant magnesium fluoride feedstock,
  - providing a c axis oriented magnesium fluoride seed crystal,
  - providing a magnesium fluoride crystal growth crucible, said crystal growth crucible having a seed crystal reservoir for receiving an oriented seed crystal,
  - inserting said c axis oriented magnesium fluoride seed crystal into said crystal growth crucible seed crystal reservoir,
  - loading said crushed magnesium fluoride feedstock into said crystal growth crucible,
  - melting said loaded crushed magnesium fluoride feedstock to provide a precrystalline magnesium fluoride melt,
  - growing a c axis oriented magnesium fluoride crystal from said precrystalline magnesium fluoride melt,
  - cooling said grown magnesium fluoride crystal to provide a magnesium fluoride laser crystal with a 42 mm crystal 120 nm transmission of at least 30%,
  - and forming said magnesium fluoride laser crystal into an excimer laser crystal optic.
2. A method as claimed in claim 1, wherein providing a magnesium fluoride crystal solid precursor includes providing a purified magnesium fluoride crystal solid precursor.
3. A method as claimed in claim 1, wherein nonmetallically crushing said magnesium fluoride solid precursor includes containing said magnesium fluoride within a flexible nonmetallic container while crushing.
4. A method as claimed in claim 1, wherein nonmetallically crushing said magnesium fluoride solid precursor includes providing a nonmetallic crusher.

5. A method as claimed in claim 1, wherein nonmetallically crushing said magnesium fluoride solid precursor includes containing said magnesium fluoride within a flexible nonmetallic container and applying a nonmetallic crushing force to said solid precursor through said flexible nonmetallic container.
6. A method as claimed in claim 1, said method including providing a contaminant scavenger and scavenging contaminants from said magnesium fluoride.
7. A method as claimed in claim 1, wherein melting said crushed magnesium fluoride feedstock to providing a precrystalline magnesium fluoride melt includes melting no more than 90% of said c axis oriented magnesium fluoride seed crystal.
8. A method as claimed in claim 1, wherein growing a magnesium fluoride crystal includes lowering said crystal growth crucible through a magnesium fluoride crystal growth temperature gradient at a rate no greater than 1 mm per hour.
9. A method as claimed in claim 1, wherein forming said magnesium fluoride laser crystal into an excimer laser crystal optic includes forming said laser crystal into a magnesium fluoride crystal optic window.
10. A method as claimed in claim 1, wherein forming said magnesium fluoride laser crystal into an excimer laser crystal optic includes forming said laser crystal into a magnesium fluoride crystal optic prism.
11. A method as claimed in claim 1, wherein said crushed low metal contaminant magnesium fluoride feedstock has metal contaminant levels less than 1 ppm by weight.
12. A method as claimed in claim 1, wherein said crushed low metal contaminant magnesium fluoride feedstock has transition element metal contaminant levels no greater than .7 ppm by weight.

13. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a Fe contamination level less than .15ppm Fe by weight.
14. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a chrome contamination level less than .06ppm chrome by weight
15. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a copper contamination level less than .02ppm copper by weight
16. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a cobalt contamination level less than .02ppm cobalt by weight
17. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has an Al contamination level less than .7ppm Al by weight
18. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a nickel contamination level less than .02ppm nickel by weight.
19. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a vanadium contamination level less than .02ppm vanadium by weight.
20. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a lead contamination level less than .02ppm lead by weight.
21. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a molybdenum contamination level less than .02ppm molybdenum by weight.
22. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a manganese contamination level less than .02ppm manganese by weight.

23. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a 42mm crystal 120nm transmission of at least 35%.
24. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has a 255nm induced absorption less than .08 Abs/42mm when exposed to 5 million pulses of 193nm light at a fluence  $\geq 40\text{mJ/cm}^2/\text{pulse}$ .
25. A method as claimed in claim 1, wherein said magnesium fluoride laser crystal has an 200 to 210 nm range absorption coefficient  $< 0.0017 \text{ cm}^{-1}$ .
26. A method of making a magnesium fluoride optical crystal, said method comprising:
- providing a magnesium fluoride crystal solid precursor,
  - nonmetallically crushing said magnesium fluoride solid precursor to provide a crushed low metal contaminant magnesium fluoride feedstock,
  - providing a magnesium fluoride crystal growth crucible,
  - loading said crushed magnesium fluoride feedstock into said crystal growth crucible,
  - melting said loaded crushed magnesium fluoride feedstock to provide a precrystalline magnesium fluoride melt,
  - growing a magnesium fluoride crystal from said precrystalline magnesium fluoride melt,
  - cooling said grown magnesium fluoride crystal to provide a magnesium fluoride optical crystal.
27. A method as claimed in claim 26, wherein providing a magnesium fluoride crystal solid precursor includes providing a purified magnesium fluoride crystal solid precursor.

28. A method as claimed in claim 26, wherein nonmetallically crushing said magnesium fluoride solid precursor includes containing said magnesium fluoride within a flexible nonmetallic container while crushing.

29. A method as claimed in claim 26, wherein nonmetallically crushing said magnesium fluoride solid precursor includes providing a nonmetallic crusher.

30. A method as claimed in claim 26, wherein nonmetallically crushing said magnesium fluoride solid precursor includes containing said magnesium fluoride within a flexible nonmetallic container and applying a nonmetallic crushing force to said solid precursor through said flexible nonmetallic container.

31. A method as claimed in claim 26, wherein said crushed low metal contaminant magnesium fluoride feedstock has metal contaminant levels less than 1 ppm by weight.

32. A method as claimed in claim 26, wherein said crushed low metal contaminant magnesium fluoride feedstock has transition element metal contaminant levels no greater than .7 ppm by weight.

33. A method as claimed in claim 26, wherein said a magnesium fluoride optical crystal has a Fe contamination level less than .15ppm Fe by weight.

34. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has a chrome contamination level less than .06ppm chrome by weight

35. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has a copper contamination level less than .02ppm copper by weight

36. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has a cobalt contamination level less than .02ppm cobalt by weight

37. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has an Al contamination level less than .7ppm Al by weight
38. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has a nickel contamination level less than .02ppm nickel by weight.
39. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has a vanadium contamination level less than .02ppm vanadium by weight.
40. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has a lead contamination level less than .02ppm lead by weight.
41. A method as claimed in claim 26, wherein said magnesium fluoride crystal has a molybdenum contamination level less than .02ppm molybdenum by weight.
42. A method as claimed in claim 26, wherein said magnesium fluoride crystal has a manganese contamination level less than .02ppm manganese by weight.
43. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has a 120nm transmission of at least 30%.
44. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has a 255nm induced absorption less than .08 Abs/42mm when exposed to 5 million pulses of 193nm light at a fluence  $\geq 40\text{mj}/\text{cm}^2/\text{pulse}$ .
45. A method as claimed in claim 26, wherein said magnesium fluoride optical crystal has an 200 to 210 nm range absorption coefficient  $< 0.0017 \text{ cm}^{-1}$ .
46. A method of making an optical fluoride crystal, said method comprising:  
providing a fluoride crystal solid precursor,  
nonmetallically crushing said fluoride solid precursor to provide a crushed low metal contaminant fluoride crystal feedstock,

- providing a fluoride crystal growth crucible,  
loading said crushed fluoride crystal feedstock into said crystal growth  
crucible,  
melting said loaded crushed fluoride crystal feedstock to provide a  
precocrystalline fluoride melt,  
growing a fluoride crystal from said precocrystalline fluoride melt,  
cooling said grown fluoride crystal to provide an optical fluoride crystal.
47. A method as claimed in claim 46, wherein providing a fluoride crystal solid precursor includes providing a purified fluoride crystal solid precursor.
48. A method as claimed in claim 46, wherein nonmetallically crushing said magnesium fluoride solid precursor includes containing said magnesium fluoride within a flexible nonmetallic container while crushing.
49. A method as claimed in claim 46, wherein nonmetallically crushing said magnesium fluoride solid precursor includes providing a nonmetallic crusher.
50. A method as claimed in claim 46, wherein nonmetallically crushing said magnesium fluoride solid precursor includes containing said magnesium fluoride within a flexible nonmetallic container and applying a nonmetallic crushing force to said solid precursor through said flexible nonmetallic container.
51. A method as claimed in claim 46, wherein said crushed low metal contaminant magnesium fluoride feedstock has metal contaminant levels less than 1 ppm by weight.
52. A method as claimed in claim 46, wherein said crushed low metal contaminant magnesium fluoride feedstock has transition element metal contaminant levels no greater than .7 ppm by weight.

53. A method as claimed in claim 46, wherein said optical fluoride crystal has a 120nm transmission of at least 30%.

54. A method as claimed in claim 46, wherein said optical fluoride crystal has a 255nm induced absorption less than .08 Abs/42mm when exposed to 5 million pulses of 193nm light at a fluence  $\geq 40\text{mJ/cm}^2/\text{pulse}$ .

55. A method as claimed in claim 46, wherein said optical fluoride crystal has a 200 to 210 nm range absorption coefficient  $< 0.0017 \text{ cm}^{-1}$ .

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